

Synchrotron Infrared Microspectroscopy of Cardiomyopathic Heart Tissue

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Beamline(s): U10B

Introduction: Abnormal remodeling of the cardiac extracellular matrix (replacement of necrotic cell tissue by collagen fibrosis, commonly understood as “scarring”) is a well-known contribution to cardiac dysfunction. We have been studying this scarring at a microscopic level with synchrotron source IR microspectroscopy to evaluate focal microdomain distribution of collagen in hearts of male UM-X7.1 cardiomyopathic Syrian hamsters at late stage (200 days). Spectra have been recorded at the U10B IR beamline.

Results: There is no apparent visible difference between normal and scarred tissue. However the collagen IR fingerprint is very distinct and easily recognized. With a bright synchrotron source, it is possible to obtain excellent quality spectra from isolated pixels (10 x 10 micron), and use the IR software to distinguish between the normal and scarred tissue. See figures below. This successful first phase has now been completed and the results will be published in a manuscript, currently in preparation. Preliminary results have been presented in two talks^{1,2}.

Conclusions: Synchrotron FTIR mapping in cardiomyopathic hamster heart is an excellent method for non-destructively determining extent of collagen fibrosis.

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References: ¹K. Gough, “FTIR mapping of molecular changes in diseased tissues,” (invited talk), SRC Users’ Meeting 2000, Synchrotron radiation Center, University of Wisconsin-Madison, Oct. 27, 2000. ² K. Gough, “Synchrotron FTIR Analysis of Molecular changes in diseased tissue”, (invited talk) Department of Chemistry, University of Toronto, Toronto, Canada, Nov. 2, 1999

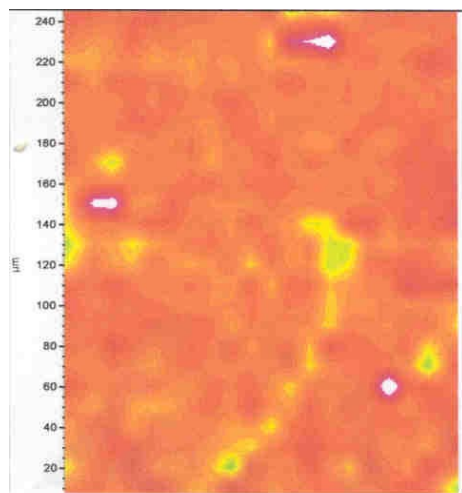


Figure 1. Control heart; 200 x 250 micron area profiled for collagen. Note small streak (yellow-green) indicating normal levels of collagen in otherwise normal (red) areas.

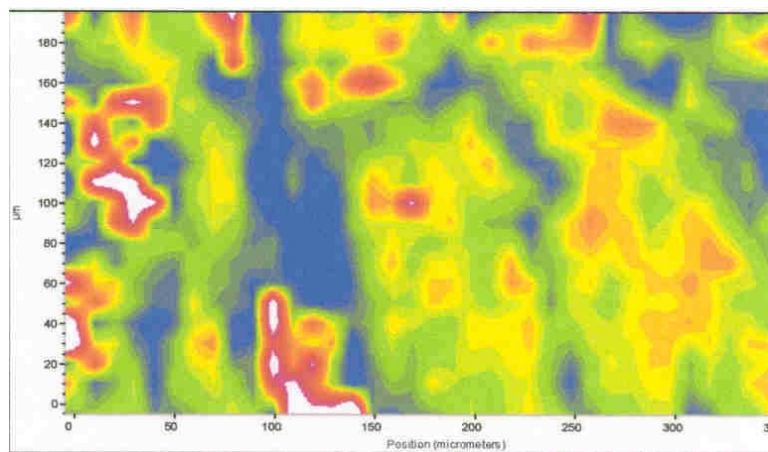


Figure 2. Cardiomyopathic heart; 380 x 200 micron area profiled for collagen. Note excessive collagen deposition (blue-green) with minimal amounts of normal (red) areas.